George R.G. Clarke[*]
Development Research Group, World Bank

The The Effect of Entreprise Ownership and Foreign Competition on Internet Diffusion in the Transition Economies

ABSTRACT

Using enterprise-level data from 21 low and middle economies in Eastern Europe and Central Asia, this paper looks at factors that influence whether enterprises in these countries are connected to the Internet. The paper finds that foreign-owned enterprises are more likely to have Internet access than domestically owned enterprises and that employee-owned enterprises are less likely to have access than other domestically owned enterprises. Further, there is evidence of positive externalities from foreign investment, with foreign direct investment increasing Internet access among domestic enterprises other than the recipient firm. In particular, the paper finds evidence of 'spillover effects', where enterprises directly competing with foreign-owned enterprises and imports are more likely to have Internet connections than similar enterprises that compete mainly with domestically owned enterprises. The results are robust to the inclusion of country fixed effects to control for unobserved country-level characteristics that might affect Internet adoption.

JEL Codes: O14, O30.

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[*] Economist, Development Research Group – Competition Policy and Regulation. The data used in this paper are from the World Business Environment Survey (WBES) ©2000 The World Bank Group. I would like to thank L. Colin Xu and Ricardo Martin for comments on earlier drafts and Luke Haggarty and Andrew Stone for their generous help with the data. Responsibility for all errors, omissions, and opinions rests solely with the author. All findings, interpretations, and conclusions expressed in this paper are entirely those of the author and do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent.

I. INTRODUCTION

After several decades of slow economic growth and modest improvements in productivity, growth accelerated in the United States in the mid- to late 1990s. Whereas output increased by only 2.8 percent per year and output per labor hour increased by only 1.0 percent per year between 1972 and 1995, they increased by 4.9 percent and 2.7 percent per year respectively between 1995 and 1999 (Gordon, 2000, p. 53). Although there is considerable uncertainty regarding the reason for the increase in growth, many observers attributed it to growing investment in information technology in general and to the Internet in particular.[1] Although the benefits of information technology are still in dispute, these changes led to considerable discussion about whether countries that failed to make similar investments would be left behind as growth in technologically more advanced economies accelerated. This concern was especially marked for low- and middle-income countries, where Internet access and the use of information technology is far less common.

The digital divide between the rich developed world and the poor developing world is visible even when comparing the mainly middle-income economies of Eastern Europe and Central Asia with high-income OECD countries. Over 25 percent of the inhabitants of high-income OECD countries had Internet access in 1999, compared to about 6-7 percent of people in Central Europe and the Baltics, and 1-2 percent of people in South Eastern Europe and the Commonwealth of Independent States.

[1] Although some formal analyses have supported the assertion that investment in information technology increased labor productivity in the 1990s, others have found only modest effects. For example, Oliner and Sichel (2000) find that 0.45 percentage points of a roughly 1 percentage point increase in labor productivity in the non-farm business sector could be attributed to investment in information technology. In contrast to results in Oliner and Sichel (2000), which suggested widespread benefits from investment in information technology, Gordon (2000) found that the gains were concentrated in computer hardware manufacturing and that there was no increase in productivity outside of durable manufacturing. Oliner and Sichel (2000, p. 19) attribute the difference in results to Gordon's (2000) treatment of cyclical effects. In a survey of firm-level evidence, Brynjolfsson and Hitt (2000) argue that the firm-level evidence suggests that information technology started affecting productivity in the early 1990s. Although several studies have found that investment in IT has improved productivity in the US, the direct impact of e-commerce is thought to be small even in the United States. For example, Oliner and Sichel (2000) estimate that e-commerce has increased multifactor productivity growth in the US by considerably less than 0.1 percent per year. Since e-commerce has almost certainly had a greater impact in the US than it has had in middle and low-income economies, the impact in the developing and transition economies is likely to be very small.

The importance of foreign investment as a source of technological transfers suggests that encouraging foreign investors from developed countries to invest in developing countries might reduce the disparity between rich and poor countries.[2] In addition to increasing the use of information technology among enterprises that directly receive inflows of foreign investment, several mechanisms might encourage diffusion among domestically owned enterprises in the host economy. For example, workers and managers who leave foreign-owned enterprises to join existing domestic firms might encourage their new employers to copy the techniques used by foreign-owned enterprises (including more intensive use of information technology). Alternatively, domestic enterprises, including competitors and upstream and downstream firms, might simply observe and copy the foreign-owned enterprises' business techniques. Since the benefits of the network industries is greater when coverage is higher, enterprises that use the Internet will generally have an incentive to encourage up- and downstream firms to adopt it. Further, although foreign-owned enterprises have strong incentives to prevent domestic competitors from copying their business models, some leakage, especially of generic knowledge such as use of information technology, seems inevitable. Finally, foreign-owned enterprises' demand for Internet services might encourage the formation of support companies (e.g., web-hosting or web-design companies) that can then sell their services to other companies in the host country.

Using enterprise level data from 21 low and middle economies in Eastern Europe and Central Asia, this paper looks at whether foreign investment increases Internet access in host countries. First, it looks at whether foreign-owned firms appear to be more likely to have Internet access than their domestic counterparts. Second, it looks at whether domestically owned enterprises competing either with foreign-owned enterprises operating in the host country or with imports also appear more likely to have access to the Internet – something that might indicate diffusion due to foreign trade or investment. Finally, the paper looks at whether FDI appears to increase Internet access for enterprises other than the foreign-owned firms and their direct competitors in the host country. In general, there appears to be strong

[2] For example, Sachs (2000) proposes FDI as a way of increasing access to technology (although not just information technology) in developing countries. Blomström and Kokko (1996), Barba Navaretti and Tarr (2000), and Saggi (2000) provide recent reviews of the literature on the effect of foreign investment and trade on the diffusion of technology in developing countries.

evidence that foreign trade and investment encourage higher levels of Internet access throughout the host economy.

Although the recent discussion on the 'digital divide' between developing and developed countries makes the question of Internet access interesting in its own right, the topic is also of interest because of its relationship with more general questions about international transfers of technology between developing and developed countries. Over the past decade, a large literature has emerged looking at how enterprises in developing countries gain access to new technologies, often focusing on the role of foreign investment and trade. In general, although foreign investment appears to result in improved productivity in the enterprises that receive the investment, there is less evidence of broad spillovers to the economy as a whole. However, since most studies have focused on the effect of foreign investment on productivity, it is possible that the negative results regarding spillovers are due to the short-term pressure that foreign entry puts on domestic enterprises through product market competition, rather than a lack of technological transfers.[3] Since this study looks at the adoption of a new technology directly, it is a useful complement to the existing literature since it avoids the possibility that pecuniary externalities will obscure technological spillovers.

II. Effect of Foreign Investment on Access to Technology

Although R&D expenditures are low in developing and transition economies, enterprises in these countries might gain access to new technologies in other ways, including foreign direct investment, joint ventures with foreign firms, licensing, and imports of capital goods.[4] Of these methods, foreign ownership is often seen as one of the most effective ways for

[3] Aitken and Harrison (1999, p. 607) suggest that entry by foreign owned enterprises that are more efficient that domestic enterprises might cause a short-term drop in the efficiency of domestic enterprises if it reduces demand for their products, stopping them from achieving economies of scale.

enterprises in developing and transition economies to gain access to new technologies. In addition to giving access to hard technological knowledge (e.g., blueprints, product designs and machinery), foreign investment might also lead to transfers of generic knowledge (e.g., improved management techniques or experience using information technology), which might be harder to transmit through methods such as licensing or imports of capital goods. Foreign investment might be especially effective in Eastern Europe and Central Asia due to their relatively large stock of skilled engineers and scientists and domestic enterprises' relative inexperience with modern marketing and management before the start of the transition.

Since it is hard to directly assess the effect of foreign investment on technology transfers, most studies have focused on the effect of foreign ownership on productivity. In general, there is strong evidence that foreign investment improves productivity in enterprises in developing and transition economies, with many recent studies finding the productivity is higher and productivity growth faster in foreign-owned enterprises in these countries. For example, in a recent study using panel data from Venezuela, Aitken and Harrison (1999) find that foreign ownership increases productivity in small, but not large, manufacturing plants, even after controlling for plant-specific effects. In contrast, Haddad and Harrison (1993) found that foreign-owned enterprises in Morocco were more productive than wholly domestically owned enterprises, but that productivity grew more slowly. Since the start of the transition, many studies have looked at the effect of foreign ownership on productivity and productivity growth in Eastern Europe and Central Asia, generally finding that foreign owned enterprises are more productive than other enterprises.[5]

Although it might not be surprising that foreign-owned enterprises are more efficient than other enterprises in developing and transition, foreign ownership might have broad benefits

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[4] Research and development (R&D) expenditures are far lower in developing and transition economies than in developed countries, both in absolute per capita terms and as a share of GDP. For example, R&D expenditures accounted for about 2.4 percent of GNP in high-income OECD countries in 1996, but only 0.8 percent of GNP in the transition economies of Europe and Central Asia, similar to the level for other low and middle-income economies. Data is from World Bank (2001), *World Development Indicators*. In 1994, the last year for which data was available, R&D expenditures accounted for about 0.84 percent of GNP in low and middle-income countries.

for the economy as a whole. In addition to affecting the technology, and productivity, of the recipient firm, foreign investment might have spillover benefits for other enterprises in the host country. Saggi (2000) lists several potential spillovers including:

1. 'Demonstration effects', where domestically owned enterprises are able to observe the technologies that the foreign-owned enterprise uses and the goods that it produces and can imitate the production processes or reverse engineer products, allowing the foreign-owned enterprises' technologies to spread throughout the economy.

2. Labor turnover, where domestic enterprises hire former employees of the foreign-owned enterprise gaining access to the foreign-owned enterprise's products or processes.

3. Vertical linkages, where foreign-owned enterprises transfer technologies or provide technical support to enterprises that are their suppliers or customers or to whom they sub-contract work.

Saggi (2000) distinguishes between these 'pure' externalities and pecuniary externalities that result from the effect of foreign investment on market structure. Since this study looks at a generic technology – access to the Internet – it is plausible that 'demonstration effects' might be important for the entire economy, not just for enterprises that are direct competitors.

Although the theoretical possibility of spillovers to other enterprises is attractive, there is little empirical evidence to support the assertion that there are large spillovers associated with foreign investment. First, although some studies have found that the mechanisms that might transmit spillovers are common, others have found little evidence of them.[6] Second, several recent studies that have looked for evidence of spillovers by looking at the effect of foreign

[5] Djankov and Murrell (2000) presents a meta-analysis synthesizing results from 23 studies that look at the effect of ownership on various measures of performance (i.e., not just productivity) in the transition economies. They find that, overall, foreign-owned enterprises appear to perform better than, or as well as, all other ownership types in the transition economies.

[6] For example, although Pack (1997) finds a large amount of labor turnover between foreign multinationals and domestic enterprises in Taiwan, Gershenberg (1987) finds only limited turnover in Kenya. In a study of 65 foreign-owned enterprises in 12 developing countries, Germidis (1977) found that there was little labor turnover, subcontracting to local enterprises or direct R&D.

entry in a given sector on the productivity of domestically owned enterprises have failed to find strong results.

In the 1970s and 1980s, a large number of studies looked at industry-level data, generally finding that productivity and productivity growth was higher in sectors with significant foreign investment.[7] However, as pointed out in Aitken and Harrison (1999, p. 611), if foreign investment is attracted to sectors that are more productive, domestic firms in these sectors would appear more productive than in other sectors even if spillovers were not important. To try to control for self-selection into industries where domestic enterprises are more efficient, several recent studies have used firm-level data, generally finding little evidence to support the assertion that spillovers are important. In fact, several studies have found that foreign entry might actually harm the productivity of their domestically owned competitors.[8] For example, using data from Morocco in the 1980s, Haddad and Harrison (1993) found that productivity growth was slower for domestic firms in sectors with high foreign investment than for firms in other sectors, although the difference was not statistically significant. In addition, Aitken and Harrison (1999) found that foreign investment in a sector actually reduced productivity for domestically owned plants in Venezuela. In a similar analysis for the Czech Republic, Djankov and Hoekman (2000) also found that foreign investment reduced the productivity of wholly domestically owned enterprises. One plausible explanation for the negative effect on domestically owned enterprises might be that foreign entry affects market structure Aitken and Harrison (2000, p. 607) note:

"If imperfectly competitive [domestic] firms face fixed costs of production, a foreign firm with lower marginal costs will have an incentive to increase production relative to its domestic competitor. In this environment, entering foreign firms producing for the local market can draw demand from domestic firms, causing them to cut production. The productivity of domestic firms would fall as they spread their fixed costs over a smaller market, forcing them back up their average cost curves. If the productivity decline from this

[7] Saggi (2000), Haddad and Harrison (1993), and Barba Navaretti and Tarr (2000) provide brief surveys of this literature. Studies include Caves (1974), Globerman (1979), Blomström and Persson (1983), Blomström (1986), and Blomström and Wolff (1989).

[8] Other enterprise level studies have found evidence of positive productivity spillovers. For example, Blomström and Sjöholm (1999) find positive spillovers on labor productivity of domestic firms from both majority and minority foreign investment in Indonesia in 1991.

demand effect is large enough, net domestic productivity can decline even if the multinational transfers technology."

This study looks at whether domestically owned enterprises that competed with foreign enterprises were more likely to have adopted a new technology (i.e., access to the Internet) not at the effect of foreign entry on domestic productivity. This allows us to identify whether foreign investment encourages the adoption of new technologies, without being concerned about negative effects on market structure.

Even if enterprises competing with foreign-owned firms were more likely to adopt the new technology (i.e., access to the Internet) than enterprises competing with domestically owned firms, this would not rule out the possibility that foreign entry has a negative impact on the productivity of domestic enterprises. First, even if domestically owned enterprises competing with foreign enterprises were more adopt the new technology than other domestic enterprises, this does not necessarily imply that they are able to use it effectively to improve productivity.[9] Consequently, it might have little impact on overall productivity. Second, even if the adoption did raise productivity, it would still be possible that negative pecuniary externalities might outweigh any positive spillovers from the adoption of the new technology.

III. EMPIRICAL RESULTS

III.1 Data

The main source of data used in this paper is the World Business Environment Survey (WBES), a cross-sectional survey of industrial and service enterprises conducted in mid-1999 by the World Bank and several other agencies.[10] The main purpose of the WBES is to identify perceived constraints on enterprise performance and growth in developing and transition economies. The survey, therefore, has a large number of questions on how taxation, regulation, the performance of the financial sector, the institutional environment and corruption affect business operations. In contrast, the survey includes little information on

[9] For example, domestic enterprises might be able to use new technologies productively only if they have sufficient levels of human capital. Consistent with this, Borensztein et al (1998) find that FDI is more productive that domestic investment only when countries have a minimum threshold of human capital.

enterprise characteristics or performance. In particular, although some information on assets, sales, broad sector of operations, ownership, employees, and enterprise growth was collected, detailed balance sheet information and profit and loss statements were not collected from participating enterprises. Further, although the WBES asked similar questions in the 80 countries, there were some differences between regions. For the purpose of this study, the most important difference was that questions on Internet access were asked only in Eastern Europe and Central Asia.[11]

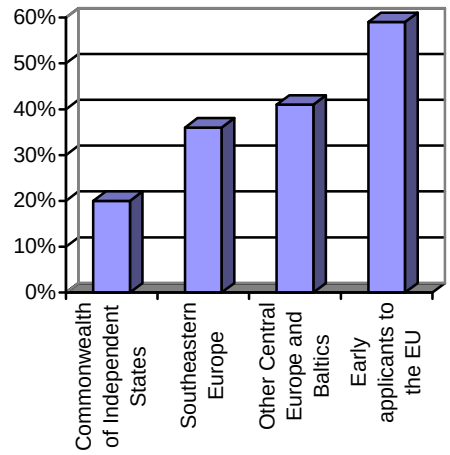

Figure 1: Percent of enterprises with access to the Internet in 1999, by region.

Data Source: World Business Environment Survey (WBES) ©2000 The World Bank Group. Note: See footnote 11 for definition of regions.

In Eastern Europe and Central Asia, about 33 percent of enterprise in the WBES sample reported having access to the Internet (see Table 1). However, this varied greatly between countries. Enterprises in Slovenia were most likely to report having access to the Internet (84.8 percent), while enterprises in Azerbaijan were least likely to report having access (7.8 percent). In general, enterprises in the CIS were less likely to report having access to the Internet than in any other region (see Figure 1). To control for country difference that might affect Internet access, either a set of country dummies or a set of country control variables are included in the

[10] The survey of the transition economies was conducted in collaboration with the European Bank for Reconstruction and Development. Hellman *et al.* (2000) and European Bank for Reconstruction and Development (1999) provide more complete descriptions of the survey.

analysis. The country level control variables include main telephone lines per 100 inhabitants, to control for development of the telecommunications sector, per capita income, urban population, and size of the country (see Table 1).

The main variables of interest are related to the enterprise's interactions with foreign enterprises. These include whether the enterprise has any foreign ownership (see Table 1), the overall level of FDI and imports into the country (see Table 1), and whether its main competitors were either foreign-owned enterprises producing in the home market or imports (see Table 2). Since most foreign investment in these countries is from the industrialized economies[12], where Internet access is more common than in Eastern Europe and Central Asia, it seems plausible that foreign-owned enterprises will be more likely to have access to the Internet than domestically owned enterprises.

The information on the enterprises' competitors comes from a question that enterprises were asked about main source of competition they faced in domestic markets. If there were substantial demonstration or labor turnover effects, enterprises facing competition from foreign-owned enterprises should be more likely to adopt similar technologies to foreign competitors than other enterprises. Further, if demonstration effects require direct observation or only occur when domestically owned companies hire former employees of their foreign competitors, then the effect of competition from foreign-owned local enterprises should be greater than the effect of competition from imports. Finally, if spillovers from foreign ownership are large, then foreign direct investment in other sectors of the economy might affect enterprises that are not direct competitors. Consequently, measures of total FDI and imports are also included in the analysis with country-level controls.[13]

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[11] The countries in the sample were: (Commonwealth of Independent States) Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Russia, Ukraine and Uzbekistan; (Early Applicants to the EU) Czech Republic, Estonia, Hungary, Poland and Slovenia; (Other Central Europe and the Baltics) Lithuania and the Slovak Republic; (Southeastern Europe) Albania, Bulgaria, Croatia, and Romania. Questions on Internet access were also asked in Cambodia, Thailand, Turkey, and the West Bank. However, since these additional countries are less comparable with the economies of Eastern Europe and Central Asia and than these economies are with each other, and because other control variables were not available for the additional countries, they are omitted from the analysis.

[12] The most important countries were Germany, the United States, the United Kingdom, France and Austria. Only 9 of the 268 foreign enterprises were from Russia.

[13] These measures are omitted when country dummies are included since they are collinear with them.

In addition to providing information on Internet Access, the survey also provided additional information on the enterprise's performance (see Table 1), the enterprise's largest shareholder, how many competitors the enterprise faced in domestic markets, how many full-time employees the enterprise had and the enterprise's sector of operations (see Table 2).[14] These are included in the analysis to control for enterprise-specific factors that might affect whether the company has Internet access. Since Internet access might affect enterprise performance rather than performance affecting Internet access, the analysis is conducted both with and without these variables.

III.2 Econometric Model

The probability that enterprise i in country j has access to the Internet is assumed to be a function of a vector of enterprise characteristics (X_{ij}) and country characteristics (Z_j). The enterprise characteristics include ownership, sector of operations, size, how the enterprise was established, competition faced by the enterprise, and, in some specifications, enterprise performance. The country characteristics include per capita income, openness to trade and investment, telephone coverage, population and urban population. The probability of enterprise i having access to the Internet is:

$$\text{Prob}\left(\text{Internet Access}_{ij}\right) = \Phi\left(\alpha + \beta X_{ij} + \gamma Z_j\right)$$

Where $\Phi(\bullet)$ is the standard normal distribution and (α,β,γ) is the vector of coefficients. The model is estimated using standard maximum likelihood estimation. All estimated models in Table 3 include dummies indicating sector of operations and size of the enterprise (See Table 2 for categories). Results from the model are shown in Table 3.

III.3 Econometric Results

[14] The WBES provided categorical information on number of employees, not the actual number.

Foreign shareholdings and largest shareholder. The coefficient on a dummy variable indicating that the enterprise has some foreign shareholders is positive and statistically significant (see Table 3, column 1). This suggests that enterprises in Eastern Europe and Central Asia that are at least partially foreign-owned are more likely to have access to the Internet than other enterprises. The results are similar whether country-level control variables or country dummies are used to control for country differences (see Table 3, columns 1 and 2). After controlling for whether an enterprise has any foreign ownership, enterprises with foreign companies as their largest shareholder do not appear any more likely to have access to the Internet than enterprises where the foreign owner is only a minority shareholder.[15] However, if the dummy variable indicating any foreign ownership is dropped, the dummy indicating that the largest shareholder is foreign becomes statistically significant and large (see Table 3, columns 3 and 4).

Foreign ownership has a large effect on the probability that the enterprise has Internet access. Whereas a state-owned enterprise without any foreign shareholders has a 24.4 percent chance of having a foreign owner (see Table 4), a foreign owned enterprise with a foreign company as its largest shareholders is twice as likely to have access to the Internet (48.8 percent). A state-owned company with some foreign ownership (i.e., a company where the government is the largest shareholder but where a foreign company has a minority stake) has a 46.8 percent chance of having access to the Internet (see Table 4).

Insider-owned enterprises appear to be less likely to have access to the Internet than other enterprises. The coefficient on the dummy variable indicating employee ownership is negative and statistically significant whether country controls or country dummies are included in the analysis. The coefficient on the dummy variable indicating that the enterprises' managers are the largest shareholders is also negative, but is statistically insignificant when country controls are included in the analysis. Based upon the coefficients in column 1 of Table 3, manager-owned enterprises have a 17.1 percent chance of having

[15] Other papers have looked at the effect of minority and majority foreign ownership on productivity. Blomström and Sjöholm found that although labor productivity was higher in Indonesian enterprises with foreign participation, that the degree of foreign ownership did not appear to have any additional effect on productivity.

Internet access, employee-owned enterprises have a 17.5 percent chance, while similar state-owned enterprises have a 24.4 percent chance (see Table 4).

Competition from foreign-owned enterprises. Enterprises who saw either foreign-owned enterprises producing domestically or imports as their main competition were more likely to have Internet access than enterprises that saw domestically owned enterprises as their main competition. In both cases, the effect is quite large. A (state-owned) enterprise whose main competition is foreign-owned enterprises producing domestically has a 34.5 percent chance of having Internet access, an enterprise whose main competition is imports has a 34.9 percent chance, whereas an enterprise whose main competition is domestically-owned enterprises has only a 24.4 percent chance (see Table 4).

The result for competition with foreign-owned enterprises producing domestically is consistent with the hypothesis that demonstration or labor turnover effects affect enterprises' decisions to adopt new technologies (access to the Internet in this case). However, the coefficient on the dummy variable indicating that imports are the enterprise's main competition is similar in size to the coefficient indicating that foreign-owned domestic enterprises are the main competition.[16] If demonstration effects were important either because of direct observation of foreign-owned enterprises' operations or because domestically owned enterprises hire workers from foreign-owned plants, the coefficient on the dummy variable indicating competition with foreign-owned enterprises producing in the country should be larger than the coefficient indicating competition with imports. Taken together, these results suggest that although openness to trade and investment increase the likelihood that domestically owned competitors have Internet access, foreign investment is no more effective than trade in this respect.

[16] We are unable to reject the null hypothesis that the coefficients are equal at conventional significance levels when either country controls or country dummies are included in the analysis.

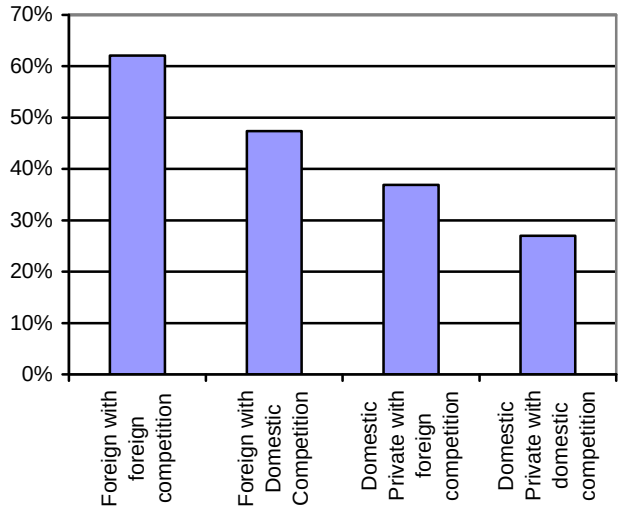

Figure 2: Probability that foreign and domestic enterprises with foreign and domestic competition have Internet access.

Note: Probabilities are calculated setting all continuous variables to their respective means and using coefficients from Table 6, column (1). The base enterprise is a state-owned enterprise, whose main competition comes from other domestically owned enterprises, with more than three competitors for its main product line, with between 50 and 100 workers (median size), in the manufacturing sector (most common sector).

One final question is whether the high probability that foreign enterprises have access to the Internet is simply due to foreign enterprises self-selecting into sectors where enterprises are more likely to have access to the Internet (i.e., sectors where access to the Internet is more useful). This is partially controlled for this by including sector dummies and dummies indicating whether the enterprise is competing with foreign or domestic enterprises. To further test whether this is the case, interaction terms between foreign ownership and competition are included in the base analysis (see Table 6, columns 1 and 2). The interaction terms are statistically insignificant indicating that foreign enterprises are more likely to have Internet access than similar domestic enterprises whether they are in sectors where their main competition is other foreign enterprises or whether they are in sectors where there main competition is domestic enterprises (see Figure 2). This further suggests that the higher probability of Internet access for foreign firms is not merely that they self-select into sectors where Internet access is more common.

Enterprise origins and competition. Enterprises that were established as either joint ventures or as private enterprises (i.e., *de novo* private enterprises) were more likely to access to the Internet than similar enterprises that either remained state-owned or had been

privatized. The difference is quite large, with *de novo* enterprises having a 38.0 percent chance of having Internet access, joint ventures having a 66.0 percent chance, while state-owned or privatized enterprises having only 24.4 percent and 27.1 percent probabilities respectively. Finally, enterprises with no effective competition were generally more likely to have Internet access than enterprises with either one to three competitors or enterprises with more than three competitors (see Table 3). However, this result is not highly robust. When variables indicating enterprise performance are included in the analysis (see Columns 5 and 6), the coefficient drops in both size and significance level. One plausible reason for this finding might be that enterprises facing little effective competition perform better, giving them the funds needed to invest in new technologies, such as Internet access.

Country-level measures of openness. In addition to the enterprise level variable discussed above, the analysis also includes some country-level variables. Since these variables become collinear with the dummies once the country dummies are added, they are dropped when country dummies are included (see Table 3, columns 2,4 and 6). The coefficient on foreign direct investment is statistically insignificant suggesting that FDI does not have a large effect on the probability that enterprises other than the enterprise the foreign company invests in (and the enterprise's competitors) have Internet access. In contrast, the coefficient on imports is statistically significant and negative. The point estimate of the coefficient suggests that the a 1 percent increase in imports decreases the probability that domestically owned enterprises have access to the Internet by 0.55 percent (see Table 5)

One concern is that the result for FDI might be affected by the inclusion of the oil producing economies of Central Asia. In particular, FDI in two of these economies, Azerbaijan and Kazakhstan, has been far higher than in any other country in the CIS since the start of transition.[17] However, this investment has almost exclusively flowed to the oil sector and it is possible that spillovers to the rest of the economy from FDI in this sector are smaller

[17] Between 1993 and 1998, there was $509 of FDI per capita in Azerbaijan and $431 per capita in Kazakhstan. In comparison, there was less than $130 per capita over the same period in the CIS and less than $100 per capita in most of the other economies. The other oil exporting countries in Central Asia have received far less FDI, $179 per capita in Turkmenistan and $31 per capita in Uzbekistan. Russia has also received far less FDI – $84 per capita over the same period. Data is from European Bank for Reconstruction and Development (2000).

than the spillovers from other FDI.[18] The results omitting the oil producing economies of Central Asia are consistent with this hypothesis. Once these economies are omitted, the coefficient on FDI increases in magnitude and becomes statistically significant at a 1 percent level (see Table 6, columns 3 and 4).[19] The point estimate of the elasticity on FDI increases to 0.21 when these economies are omitted.

Country Controls. The other country controls are also significant at at least a 5 percent level throughout the analysis. In general, enterprises in countries with higher per capita income, with larger urban populations and smaller countries appear more likely to have access to the Internet. In addition, enterprises in countries with more developed telecommunications systems appear to be more likely to have access to the Internet. A 1 percent increase in the number of mainlines per 100 inhabitants increases the probability that an enterprise has access to the Internet by 0.5 percent. This result is consistent with results from a country-level analysis in Dasgupta et al (2000), which suggest that that cross-country differences in Internet use reflect the number of fixed mainlines per capita in a country. Including country dummies does not appear to either affect the enterprise level results or to increase the explanatory power of the analysis – the pseudo R-squared is similar whether country dummies or country controls are included (see Table 3 and Table 6).

Enterprise Performance. As a final set of control variables, some additional indicators of enterprise performance are also included in the analysis, including employment and sales growth – in general, better performing enterprises should contract less than worse performing enterprises – and percent of sales to the government. Since there is a large literature showing that foreign-owned enterprises in the transition economies generally perform better than domestically owned enterprises along a variety of dimensions, foreign-owned enterprises might be more likely to have access to the Internet, simply because their stronger performance

[18] For example, in 1998, there was $129 of FDI per capita in Azerbaijan. However, there was only $24 per capita outside of the oil sector. Excluding investment in the oil sector, FDI in Azerbaijan was similar to the level in other CIS economies for that year. Data is from International Monetary Fund (2000).

[19] Most of the other results of interest do not appear to be affected by this change. The only changes are that the coefficient on the dummy indicating that the enterprise has no competitors in its main market becomes statistically insignificant and the coefficient on urban population becomes insignificant when the country controls (rather than country dummies) are included in the analysis.

gives them better access to investment resources.[20] Similarly, employee-owned enterprises, which appear to perform worse than other enterprises, might have fewer resources for investment.[21]

In general, better performing enterprises appear to be more likely to have access to the Internet than worse performing enterprises (see Table 3), perhaps because they have more resources available for investment in new technologies. However, this has virtually no effect on other results. Most notably, the coefficients on foreign- and insider-ownership are virtually unchanged and remain highly significant even after these performance measures are added to the analysis. This suggests that better (worse) performance is not the only reason for the higher (lower) levels of access to the Internet for foreign- (employee-) owned enterprises.

Although performance might affect Internet access, Internet access might also affect enterprise performance, introducing the possibility of reverse causation when the performance variables are included. Therefore, the analysis is conducted both with and without these variables (see columns 1 and 2 and columns 5 and 6 in Table 3 respectively). In practice, the main results are virtually identical whether these performance indicators are included in the analysis or not.

IV. CONCLUSIONS

The results from this study support the assertion that foreign investment increases Internet access for enterprises in low and middle-income countries in Eastern Europe and Central Asia. The strongest result is that Internet access is more common among enterprises that are partly foreign-owned than it is among enterprises that are fully domestically owned. The effect of foreign ownership appears large – enterprises that are partly foreign-owned are almost twice as likely to have access to the Internet as state-owned and privately owned enterprises with no foreign ownership. Further, the correlation between foreign ownership and Internet access does not seem to be simply because foreign-owned enterprises tend to out-perform other enterprises in the transition economies, giving them easier access to financing.

[20] See footnote 5. Better performing enterprises might both have better access to capital markets and have higher retained earnings. Given the underdeveloped nature of the banking systems and capital markets in these countries, retained earnings are a vital source of resources for investment in the transition economies.

The correlation remains statistically significant even after including variables to control for enterprise performance and indicators of the level of competition that the enterprise faces in domestic markets.

The results also suggest that foreign investment has positive spillovers for other domestically owned enterprises with respect to Internet access. In particular, the results suggest that enterprises that compete with either foreign-owned domestic enterprises or imports are more likely to have Internet access. Since competition with imports and foreign-owned domestic enterprises both appear to increase the likelihood, this suggests that proximity is not very important. Although past studies (e.g., Aitken and Harrison, 1999) have found that competition from foreign-owned firms reduces the productivity of their domestic competitors, the negative effect of foreign entry on the productivity of domestic competitors is thought to be due to foreign entry affecting market structure. Since this study does not address the question of the size, or even existence, of benefits related to Internet access, it is unclear whether positive technological spillovers found in this study would outweigh pecuniary externalities.

Finally, Internet access appears more common in countries with higher levels of FDI even after controlling for other factors (e.g., urbanization, per capita income and telecommunications infrastructure) that might also affect Internet access. It is important to note that this result holds only after the oil-exporting economies of Central Asia are excluded from the analysis. This strongly suggests that FDI does not always increase the likelihood that a domestic enterprise will have Internet access – spillovers from investment in a single (extractive) sector might not have the same beneficial spillover effect as other types of investment.

Other factors also affect Internet access. Employee-owned enterprises are less likely to have access to the Internet than other enterprises, including state-owned enterprises. This holds when country dummies and performance measures are included in the analysis, suggesting that it is not due to employee ownership being more common in countries where

[21] The meta-analysis in Djankov and Murrell (2000) indicates that ownership by foreign enterprises and individuals, ownership by investment funds, ownership by managers, and concentrated individual ownership was

Internet access is restricted or to employee owned enterprises finding it harder to finance new investment. Finally, enterprises in countries with better telephone systems are more likely to have Internet access even after controlling for income and urbanization. This result is consistent with results from a country-level study by Dasgupta et al (2000), which suggests that the number of mainlines per capita explains most of the gap between developed and developing countries with regards to Internet connectivity. This stresses that steps that would improve the performance of providers of fixed-line telephone services (e.g., privatizing state-owned fixed line monopolies) would increase Internet access.

The presence of positive spillovers from foreign investment suggests that it might be appropriate for governments to take steps to encourage foreign direct investment. However, although there is some evidence that investment in information technology has improved the productivity of enterprises in the U.S, there is very little evidence on the how great the effect of Internet access or investment in information technology is on firm performance in developing or transition economies.[22] Although the lack of evidence regarding the effect of Internet access on firm performance in the transition economies argues against taking dramatic steps to encourage foreign investment, it does give added weight to arguments for improving the business environment. For example, there is strong evidence that corruption, which is a serious problem in many transition economies, discourages foreign investment and slows economic growth.[23] Since reducing corruption and taking other steps to improve the business environment would both encourage foreign investment and improve the functioning of the domestic economy, they would benefit the domestic economy even if Internet access had little short-term impact on productivity or growth.

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more effective than employee-ownership at improving enterprise performance.

[22] One study that looks at the effect on the Internet on firm performance in transition economies, Clarke (2001), finds that export growth is faster for industrial enterprises in transition economies with Internet export than for non-connected firms even after controlling for self-selection bias.

[23] Mauro (1995) shows that corruption has a large and statistically significant effect on economic growth. In addition, several recent papers have found that corruption is negatively correlated with foreign direct investment. Wei (1999), who uses FDI data from 45 developing and developed countries from 12 OECD countries, finds that corruption in the host country has a statistically significant effect on foreign direct investment. The effect is quite large – a one-point increase in corruption (on a five-point scale) would decrease foreign direct investment by about 16 percent. Similarly, Gastanga et al. (1998) also find that corruption reduces foreign direct investment in a sample of 45 less-developed countries.

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VI. TABLES

Table 1: Means and standard deviations of variables.

Variable	Source	Mean	Standard Deviation
Enterprise Characteristics			
Does enterprise have access to the Internet? (1-yes,0-no)	WBES	0.33	0.47
Does any foreign company have a financial stake in your organization	WBES	0.08	0.27
Percentage change in employment between 1996 and 1999.	WBES	6.52	60.39
Percentage change in sales between 1996 and 1999.	WBES	13.43	67.33
Percent of sales accounted for by state sector.	WBES	16.93	25.50
Country Control Variables			
Net incoming foreign direct investment in 1998 (share of GDP)	WDI	4.54	5.11
Imports of goods and services in 1998 (share of GDP)	WDI	46.68	17.91
Main telephone lines per 100 inhabitants in 1999	ITU	22.09	10.61
Urban Population (share of total) in 1998	WDI	61.69	12.33
Per capita GDP in 1998 (PPP, international dollars, 000s).	WDI	5.91	3.18
Population in 1998 (natural log)	WDI	16.41	1.38

Note: For source variables, WBES implies that data comes from the World Business Environment Survey (WBES) ©2000 The World Bank Group. WDI implies that data comes from World Bank, 2001. *World Development Indicators*. World Bank, Washington DC. ITU implies that data comes from International Telecommunication Union, 2000. World Telecommunication Indicators Database. International Telecommunication Union, Geneva, Switzerland.

Table 2: Distribution of enterprises in sample.

What is biggest competitive threat to enterprises? (omitted category is domestic enterprises)	
Foreign firms producing in domestic markets (not imports)	7.4%
Legal and illegal imports	11.0%
Who is the largest shareholder in enterprise? (omitted category is government)	
A foreign company	3.4%
Enterprise's managers	2.9%
Enterprise's employees	11.0%
Other private (individuals, families, domestic companies, banks or investment funds)	65.6%
How was enterprise established? (omitted category is state-owned, including subsidiaries and privatized state-owned)	
Private from time of start up (no state-owned predecessor)	53.3%
Joint venture with foreign and domestic partners	1.3%
How many competitors does enterprise's major product line face in domestic markets? (omitted category is more than three)	
Between one and three	9.9%
No competitors	12.6%
How many full-time employees and casual staff in total work for this company? (omitted category is over 500)	
Less than nine	26.5%
Between 10 and 49?	20.0%
Between 50 and 99?	16.0%
Between 100 and 199?	13.7%
Between 200 and 499?	15.4%
What is enterprise's main area of activity? (Omitted category is 'other')	
Farming, fishing or forestry	13.5%
Mining or quarrying	0.8%
Manufacturing	29.7%
Building or construction	8.8%
Power generation	0.4%
Wholesale trade	12.5%
Retail trade	14.4%

Transportation	6.1%
Financial services	1.6%
Personal services	5.3%
Business services	4.9%

Data Source: World Business Environment Survey (WBES) ©2000 The World Bank Group

Table 3: Effect of ownership on probability of enterprise having Internet access.

Estimation Method	**Probit**	**Probit**	**Probit**	**Probit**	**Probit**	**Probit**
Dependent Variable	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet
Number of Observations	2999	2999	3006	3006	2798	2798
Sector Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Size of Enterprise Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	No	Yes	No	Yes	No	Yes
Foreign shareholding						
Any foreign shareholding	0.6125 *** (4.67)	0.6361 *** (4.69)			0.5810 *** (4.10)	0.6265 *** (4.28)
Ownership						
Largest Shareholder – Foreign	0.0518 (0.24)	0.0404 (0.18)	0.6497 *** (3.66)	0.6496 *** (3.58)	-0.0101 (-0.04)	-0.0183 (-0.08)
Largest Shareholder – Managers	-0.2581 (-1.49)	-0.3436 * (-1.95)	-0.2041 (-1.19)	-0.2853 (-1.63)	-0.2139 (-1.17)	-0.3097 * (-1.66)
Largest Shareholder – Employees	-0.2398 ** (-2.04)	-0.3049 ** (-2.51)	-0.2304 ** (-1.97)	-0.2950 ** (-2.43)	-0.2811 ** (-2.31)	-0.3228 *** (-2.56)
Largest Shareholder – Other Private	0.0823 (0.86)	-0.0051 (-0.05)	0.1174 (1.23)	0.0322 (0.33)	0.0504 (0.50)	-0.0305 (-0.29)
Competition from foreigners						
Main Competition – imports	0.3054 *** (3.50)	0.3118 *** (3.47)	0.3200 *** (3.69)	0.3265 *** (3.66)	0.3309 *** (3.62)	0.3378 *** (3.59)
Main Competition – foreign-owned domestic enterprises	0.2944 *** (2.92)	0.2608 ** (2.52)	0.3036 *** (3.05)	0.2693 *** (2.64)	0.2370 ** (2.28)	0.2059 * (1.93)
Enterprise-level controls						
Firm Established as Private	0.3043 ***	0.3220 ***	0.3127 ***	0.3259 ***	0.2156 ***	0.2445 ***

Enterprise	(3.92)	(4.01)	(4.06)	(4.10)	(2.62)	(2.88)
Firm Established as Joint Venture	0.4944 ** (2.07)	0.5024 ** (2.00)	0.6982 *** (3.04)	0.7150 *** (2.97)	0.4666 * (1.85)	0.5184 ** (1.97)
Between one and three competitors.	-0.0141 (-0.14)	-0.0554 (-0.53)	0.0059 (0.06)	-0.0309 (-0.30)	0.0285 (0.27)	-0.0317 (-0.29)
No competitors	0.1709 ** (2.10)	0.1441 * (1.73)	0.1814 ** (2.24)	0.1536 ** (1.86)	0.1516 ** (1.77)	0.1290 (1.48)
Country-level measures of openness						
Foreign Direct Investment (% of GDP)	0.0063 (0.85)		0.0051 (0.69)		0.0062 (0.80)	
Imports (% of GDP)	-0.0119 *** (-4.42)		-0.0119 *** (-4.48)		-0.0121 *** (-4.33)	
Country controls						
Number of telephone lines per 100 inhabitants	0.0228 *** (4.00)		0.0226 *** (3.99)		0.0208 *** (3.46)	
Urban Population (percent of population)	0.0100 ** (2.44)		0.0096 ** (2.37)		0.0113 *** (2.65)	
Per Capita GDP (000s of US$)	0.0826 *** (5.40)		0.0814 *** (5.33)		0.0815 *** (5.10)	
Population (Natural Log)	-0.1713 *** (-4.33)		-0.1793 *** (-4.59)		-0.1900 *** (-4.56)	
Enterprise-level performance						
Employment Growth (over last three years)					0.0023 *** (3.96)	0.0022 *** (3.78)
Sales Growth (over last three years)					0.0017 *** (3.61)	0.0017 *** (3.70)
Sales to Government (% of sales)					0.0009 *** (0.71)	0.0017 (1.33)
Pseudo R-Squared	**0.25**	**0.28**	**0.25**	**0.27**	**0.27**	**0.29**

Note: t-statistics in parentheses *** Significant at 1 percent level ** Significant at 5 percent level * Significant at 10 percent Level

Data Source: The World Business Environment Survey (WBES) ©2000 The World Bank Group.

Omitted categories are state-owned enterprises (as largest shareholders) and enterprises established as state-owned enterprises (origin)

Table 4: Effect of dummy variables on probability of having access to the Internet.

	Probability of having Internet access
Base Enterprise	**24.4%**
Foreign shareholding	
Any foreign shareholding	46.8%
Ownership	
Largest Shareholder – Foreign [a]	48.8%
Largest Shareholder – Managers	17.1%
Largest Shareholder – Employees	17.5%
Largest Shareholder – Other Private	27.1%
Competition from foreigners	
Main Competition – imports	34.9%
Main Competition – foreign-owned domestic enterprises	34.5%
Enterprise-level controls	
Firm Established as Private Enterprise [b]	38.0%
Firm Established as Joint Venture between foreign and domestic enterprises [c]	66.0%
Between one and three competitors.	24.0%
No competitors	30.1%

Note: Probabilities are calculated setting all continuous variables to their respective means and using coefficients from Table 3, column (1). The base enterprise is a state-owned enterprise, whose main competition comes from other domestically owned enterprises, with more than three competitors for its main product line, with between 50 and 100 workers (median size), in the manufacturing sector (most common sector). All other enterprises are

the same as the base type with changes as noted in the title column. [a] If the largest shareholder is foreign, the dummy indicating any foreign shareholder is also set to "1". [b] If the firm is established as private, the dummy indicating that the largest shareholder is (other) private (i.e., not state-owned) is also set to "1". [c] If the firm is a joint venture between foreign and domestic, the dummy indicating some foreign shareholding is set to "1".

Table 5: Elasticities of the probability of having Internet access with respect to continuous variables.

Variable	**Elasticity**
Country-level measures of openness	
Net incoming foreign direct investment in 1998 (share of GDP)	0.03
Imports of goods and services in 1998 (share of GDP)	-0.55***
Country Control Variables	
Main telephone lines per 100 inhabitants in 1999	0.50***
Urban Population (share of total) in 1998	0.62**
Per capita GDP in 1998 (PPP, international dollars, 000s).	0.49***
Population in 1998 (natural log)	-0.17***
Enterprise-level performance	
Percentage change in employment between 1996 and 1999.	0.04***
Percentage change in sales between 1996 and 1999.	0.03***
Percent of sales accounted for by state sector.	0.03***

*** Significant at 1 percent level ** Significant at 5 percent level * Significant at 10 percent Level

Note: Probabilities are calculated setting all continuous variables to their respective means and using coefficients from Table 3, column (1). The base enterprise is a state-owned enterprise, whose main competition comes from other domestically owned enterprises, with more than three competitors for its main product line, with between 50 and 100 workers (median size), in the manufacturing sector (most common sector).

Table 6: Effect of ownership on probability of enterprise having Internet access.

Estimation Method	**Probit**	**Probit**	**Probit**	**Probit**
Dependent Variable	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet	Enterprise has access to Internet
Sample	**All**	**All**	**Oil Exporters Omitted**	**Oil Exporters Omitted**
Number of Observations	2999	2999	2638	2638
Sector Dummies	Yes	Yes	Yes	Yes
Size of Enterprise Dummies	Yes	Yes	Yes	Yes
Country Dummies	no	No	No	No
Foreign shareholding				
Any foreign shareholding	0.6280*** (4.26)	0.6579*** (4.31)	0.7015*** (4.95)	0.7256*** (4.95)
Interaction Term				
Foreign companies facing competition from foreign-owned companies	0.0937 (0.32)	0.0932 (0.31)		
Foreign companies facing competition from imports	-0.1543 (-0.56)	-0.1799 (-0.64)		
Ownership				
Largest Shareholder – Foreign	0.0416 (0.19)	0.0268 (0.12)	-0.1514 (-0.65)	-0.1592 (-0.66)
Largest Shareholder – Managers	-0.2620 (-1.51)	-0.3487** (-1.98)	-0.2946* (-1.67)	-0.3684** (-2.04)
Largest Shareholder – Employees	-0.2407** (-2.05)	-0.3061** (-2.52)	-0.2571** (-2.06)	-0.3304**

				(-2.55)
Largest Shareholder -- Other Private	0.0811 (0.84)	-0.0065 (-0.07)	0.0644 (0.62)	-0.0252 (-0.23)
Competition from foreigners				
Main Competition – imports	0.3220*** (3.52)	0.3312*** (3.52)	0.3200*** (3.42)	0.2952*** (3.09)
Main Competition – foreign-owned domestic enterprises	0.2785*** (2.57)	0.2441** (2.20)	0.2426** (2.32)	0.2193** (2.04)
Enterprise-level controls				
Firm Established as Private Enterprise	0.3036*** (3.90)	0.3211*** (4.00)	0.3030*** (3.72)	0.3230*** (3.83)
Firm Established as Joint Venture	0.4961** (2.06)	0.5035** (1.99)	0.4593* (1.72)	0.5013* (1.78)
Between one and three competitors.	-0.0150 (-0.15)	-0.0565 (-0.54)	0.0442 (0.41)	-0.0156 (-0.14)
No competitors	0.1715** (2.10)	0.1447* (1.73)	0.1184 (1.38)	0.0937 (1.06)
Country-level measures of openness				
Foreign Direct Investment (% of GDP)	0.0061 (0.83)		0.0463*** (3.54)	
Imports (% of GDP)	-0.0118*** (-4.39)		-0.0125*** (-4.57)	
Country controls				
Number of telephone lines per 100 inhabitants	0.0227*** (3.97)		0.0193*** (3.20)	
Urban Population (percent of population)	0.0099*** (2.42)		0.0063 (1.38)	
Per Capita GDP	0.0830***		0.0990***	

(000s of US$)	(5.41)		(6.11)	
Population (Natural Log)	-0.1705*** (-4.30)		-0.1189*** (-2.76)	
Pseudo R-Squared	**0.25**	**0.28**	**0.25**	**0.27**

Note: t-statistics in parentheses *** Significant at 1 percent level ** Significant at 5 percent level * Significant at 10 percent Level

Data Source: The World Business Environment Survey (WBES) ©2000 The World Bank Group.

Omitted categories are state-owned enterprises (as largest shareholders) and enterprises established as state-owned enterprises (origin)